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Games based learning: A case of learning Physics using Angry Birds

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Abstract

Background/Objectives: Game-Based Learning (GBL) is an emerging term that has attained focus and appreciation at a remarkable level these days, the GBL plays a significant role to learn through games. Angry Birds (AB) is one of the games which are very popular among kids that they mostly spend more than 8 hours of the whole day to play this game. AB's popularity among the kids is due to its user-friendly easy interface and easy rules. Interface and rules of the game reveal primary physics theories and concepts. This study is conducted to modify the AB interface in such a way that basic physics concepts can be taught to secondary school students using this Game Based Tool (GBT). The objective is to provide GBL tool to teachers and students. That will be helpful for teachers to teach the physics concepts in an interesting way to students. **Methods/Statistical analysis:** The interface of the AB game is modified in such a way that while students perform various actions to kill the targeted pigs, to hit the objects for scoring, they will be able to learn physics, i.e., projectile motion and some basic concepts of physics involved in achieving the goals. This paper will present the modified interface of AB and how that is used for physics learning. This study is carried to attempt the mentioned objective. The experiment was conducted on 80 students of secondary school, i.e. group 1 played traditional AB game and learned physics in classroom without gaming aid and group 2 learned physics theories in class and used the modified AB game for playing game additionally learned physics from the actions they performed during play. **Findings:** This study shown that simple and interesting games can be used for learning scientific theories for secondary school students. The study achieved improved results after implementing the lectures using GBL tool to teach physics. 30% of 40 students got 80% of scores in class using GBLT while 25% of 40 students got 80% in class without supplementary GBT. **Novelty/Applications:** This GBT may be advantageous for teachers and students.

Keywords: GameBased learning; angry birds; Physics learning; mobile games

1 Introduction

The essence of education is achieved when the learners can attain maximum learning easily with motivation to learn. To achieve this core of education, many of the methods are being used by the researchers and academicians throughout the Globe, i.e., Information and communication Technology (ICT) tools usage, Context aware educational systems by understanding users' needs [1–15]. Game-Based Learning is a kind of game perform that defined learning results. Digital game based learning (DGBL) denotes to the usage of the amusing influence and power of a digital game for educational objective/goal [16]. The capability of the player to maintain and apply scientific content to the actual world. Generally, it aims at equality of true context, subject, and player problem. It is found from the previous work that students are spending huge time on smart-phones, laptops using for earning fun and enjoyment. [17] GBL appraises novel and advanced learning techniques. Without game-based instructional strategies the children don't get the benefit as they can Several video games are used for learning purposes in the classroom although Angry Birds got extra admiration and attention among all presented by Rovio. [18,19] AB is a famous puzzle game and built on physics rules in which the objective is to kill completely the pigs inside 2D level location using a large quantity of birds. Every level has a set task/goals to proceed to the next level. Nowadays, youngsters frequently play AB game approximately 6 to 8 hours a day [20] subsequently, the players will not play the game but can learn several subjects such as mathematics and physics. Several interesting scenarios are provided in this game to complete various level. These scenarios may be used to teach numerous concepts (theories). Several past research studies have highlighted the facts that digital games (mobile games) can be used as teaching and learning tool, i.e. It is reported in [21,22] that due the variety of students in a class minor level of learning efficiency issues are found. Several years were spent to develop comprehensive teaching plans, tools, and approaches in this concern. Nowadays, the ration of access mobile devices has increased among the students. The researcher described mobile based design for teaching in class and off-class activities through an online response system [23]. [21] described mobile development application based android platform that incorporates approaches for developing higher-order thinking skills and applied in the management of activities. [24] investigated practice-based of teachers through digital games playing in the school room. In [25] the authors examine the effect of GBL for developing and enhancing the problem-solving methods, on reasoning and concluded the positive effect on cognitive skill development. This study demonstrated the better learning outcomes in Mathematics. [26] has appraised that the use of Mobile devices has not limited only average aimed at conveying personalized. The study endorsed that mobile based learning facilitates the pervasive assessment activities. The number of articles with published year are shown in Figure 1. However, [27] has appraised Media self-efficiency has framed using mobile increased actuality which has measured capable of giving students a well-learning. [28] endorsed that video game Angry bird with modifications can be used to alter the perceptions of the students regarding motion of objects. While [29] enlightened the methods to use mobile game angry bird to learn "projectile motion" easily by the students of physics. From these studies, it became the motivation that AB game interface can be modified to involve basic physics concepts for Middle school students therefore, this study is undertaken to modify Angry birds game in such a way that it can be used as a learning tool in conjunction with other learning material to learn physics. Moreover, this game may be used as an experiential tool for physics learning and may facilitate teachers to teach the course.
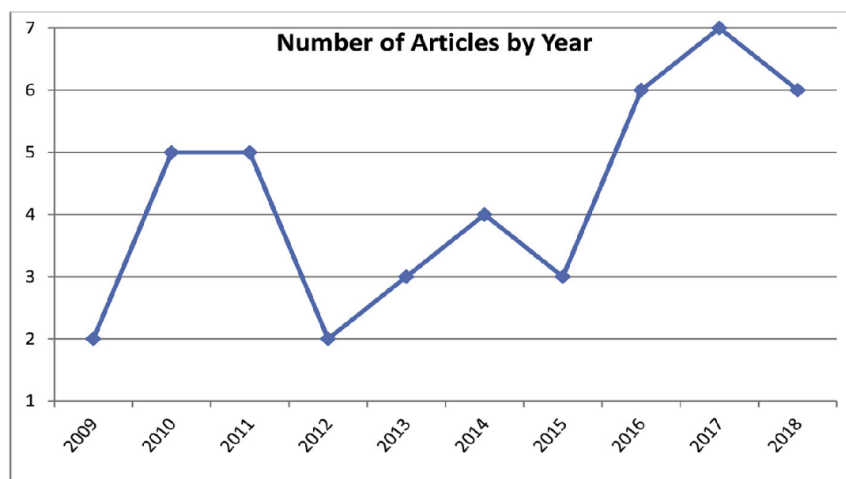

Fig 1. Number of articles by year [22]

2 Research Methodology

This research is used to introduce an efficient game-based tool for e-learner to enhance its physics learning. The tool is designed for the higher secondary students which is based on basic principles of physics such as projectiles motion, distance, velocity, object health and distance etc. To experiment the GBL tool, the GBL tool was tested on learners of "School of Excellence Sukkur". Around 80 learners were chosen and were

distributed in to two sets. The classes were conducted in two styles; one was manual lectures and second tool-based lectures. Lastly quiz was conducted to evaluate the results of method. It has proven that the tool-based lecture can give efficient results as compare to other techniques. We have reviewed many past research article in which various digital games were used as supplementary learning tool to enhance students' learning. We chose Angry birds game to modify its interface for learning basic principles of physics, i.e., distance, projectiles motion, velocity etc. Figure 2 is used to present the research study steps. This modified Angry birds game was experimented and tested on students of class VIII of a Government secondary school, at Sukkur, Sindh, Pakistan. Eighty students were selected and divided into two groups. Basic physics theories were taught in two groups with different teaching styles, i.e., one group was taught the same theories with traditional face to face teaching method, i.e., lecture + book material. However, the other group was taught with same method with an additional teaching aid of game based tool. At the end, monthly test was conducted using multiple choice questions (solvable problems) comprised of 30 questions. The tool-based lectures have presented capable outcomes as matched toward different approaches.

3 Result and Discussion

An experiential learning tool / Game Based Tool (GBT) for Secondary School students was developed to enhance the understanding of primary concepts of physics. It was built on the AB's scenarios to teach the concepts of distance, velocity, projectiles motion etc. The modified interface of the game was developed using "Urho3D" which was implemented C++, Java script and Angle script. The illustration of game-based tool Development and Design is given using Figures 3, 4, 5 and 6 .
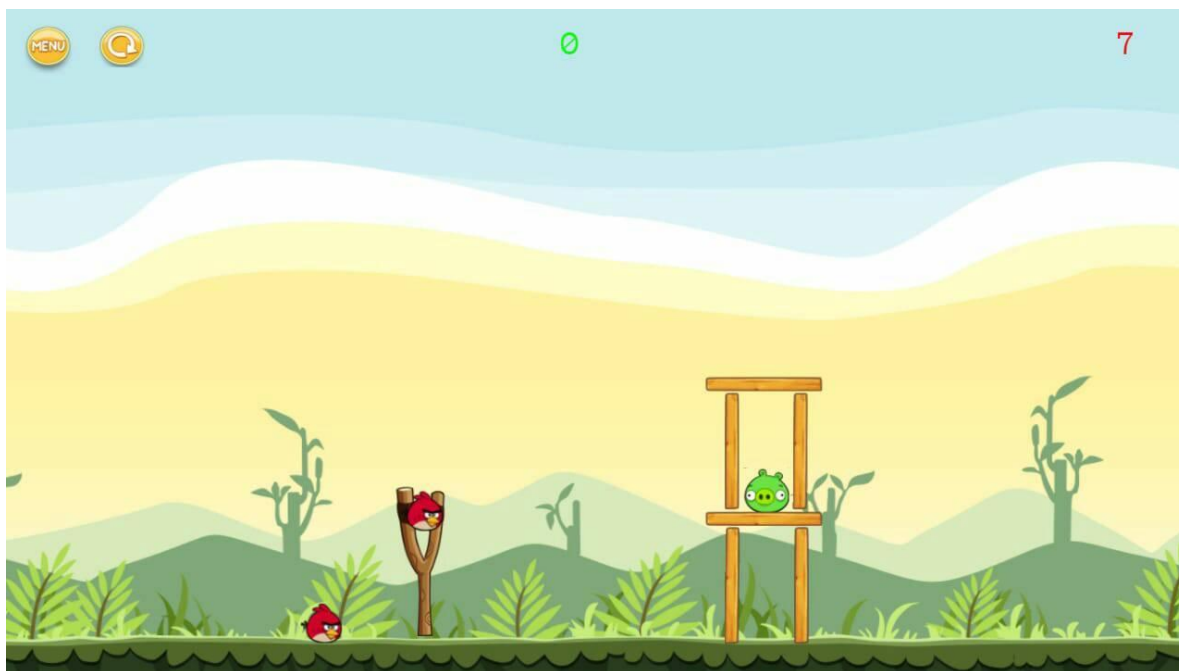

Fig 2. Flow chart of research work

Fig 3. Snapshot of the interface of the tool
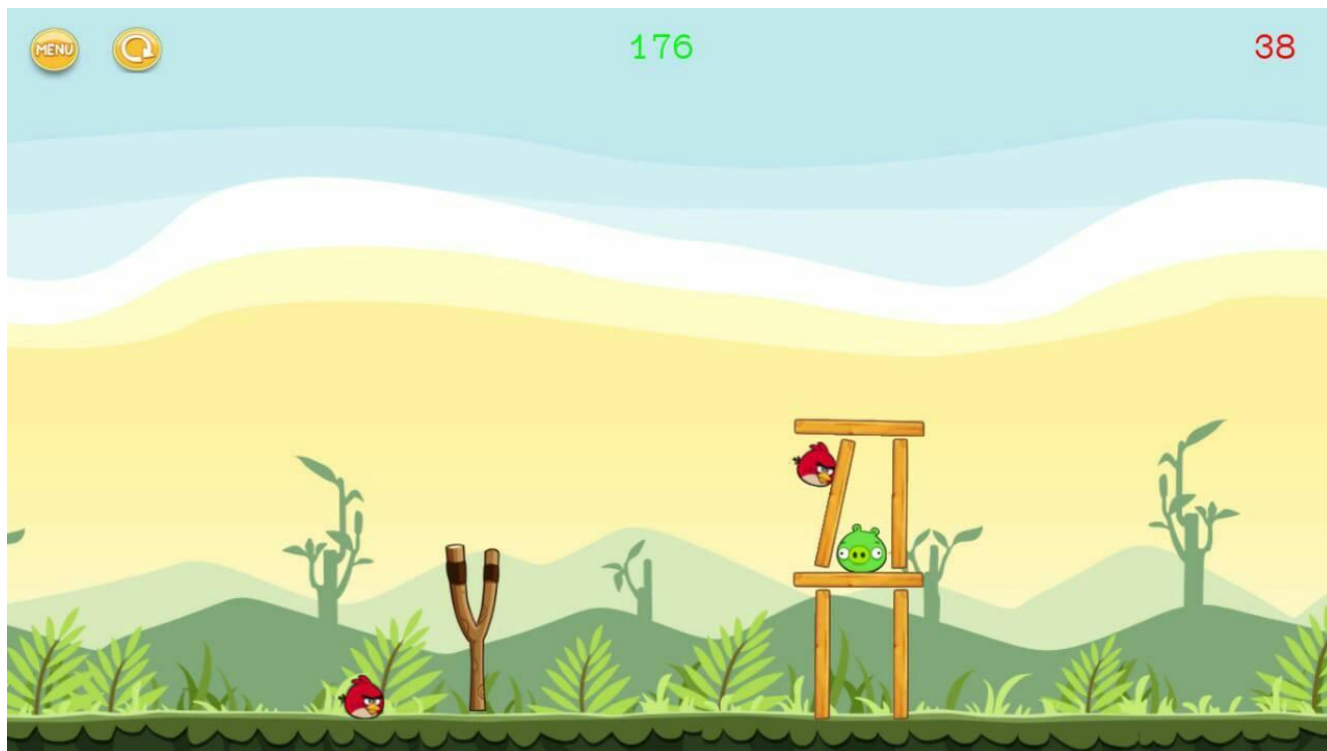
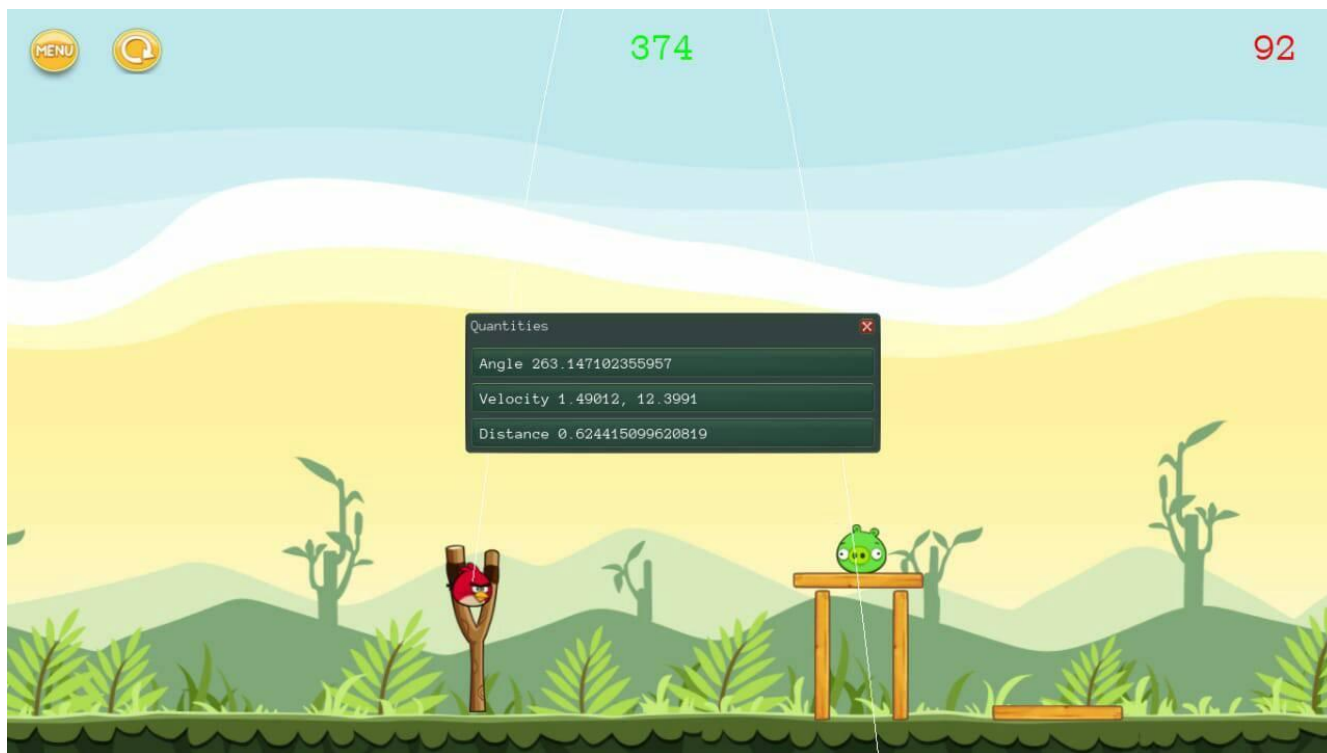**Fig 4.** Snapshot of the bird hitting the building where the pig is

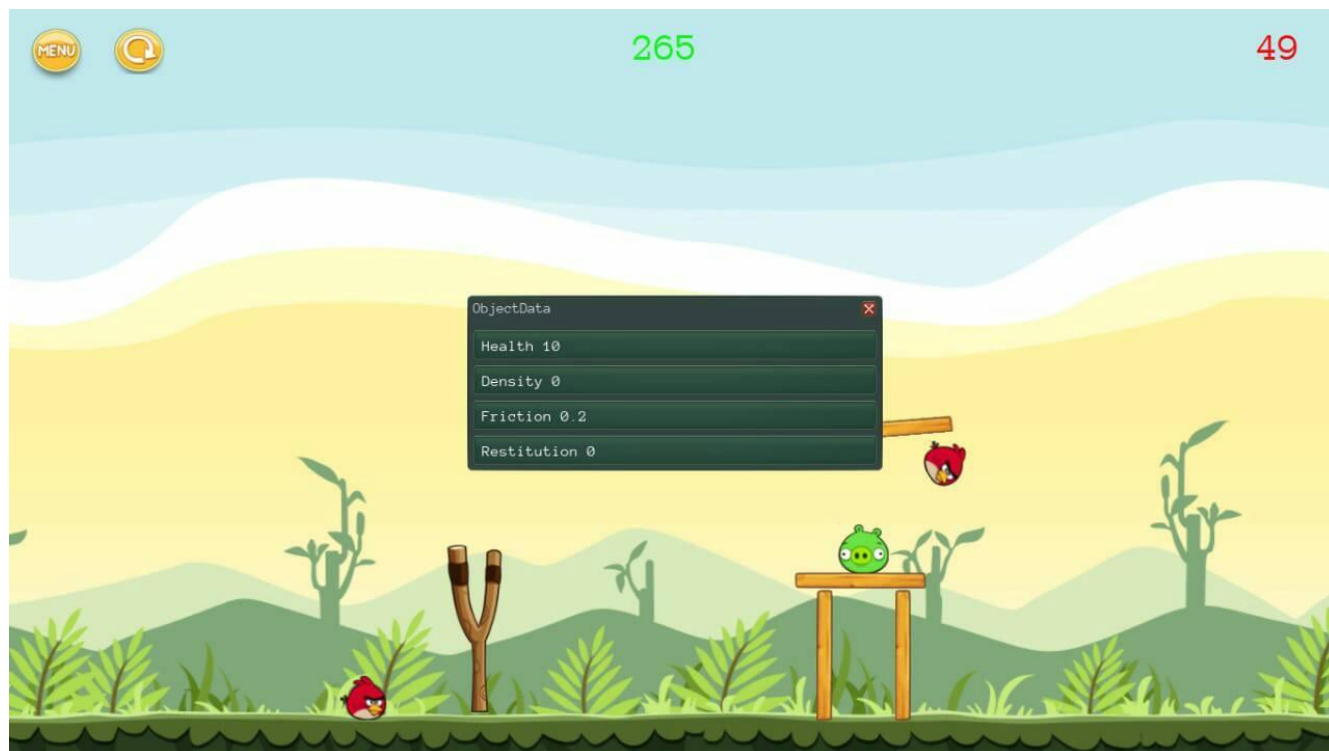**Fig 5.** Snapshot of the game interface with physics quantities

Fig 6. Snapshot of the game interface with physics quantities

Various scenes were used in the game, i.e., Splash Scene, Start Menu Scene, Stage Menu Scene, and Play Game Scene. Our research presents a capable GBT for learners toward teaching the primary concepts of physics as projectile motion, velocity, distance, to experiment with the GBT, the GBT checked on learners. Eighty students of Class VIII from a Government secondary school of Sukkur region Sindh, Pakistan were selected and distributed into two sets. The class has been conducted into two ways that consist of tool-based lectures and manual lectures. After one month, the monthly test (Multiple Choice Questions) has arranged to estimate the results of methods. The tool-based lectures have presented effective outcomes as matched to different approaches. Our research appraised physics quantities such as kinematics, projectile, and object health in the frame of angry birds although the additional rules of physics such as the law of conservation and rule of momentum could be learned from additional birds in framework of the same game. Games are given several opportunities to explore physics in new platforms and styles to motivate the students to learn physics in the framework of multimedia tools. In this technological world where everything is to be counted on technology, teachers are also required to use techniques and tools in the classroom to lead students to learn properly and efficiently. The main objective of this study is to develop the game based tool which is helpful for the teacher and students. The net results of whole examination advised to regard GBT are emerging. From the experiment conducted in two groups, i.e., using GBT with lectures and without GBT, the study attained the results shown in Figure 7. It is shown that when the GBT used in class as a supplementary tool for lectures, 30% of the class obtained 80% of scores while 25% of the students obtained 80% of the scores in the class where the lectures conducted without GBT.

4 Conclusion

Game-based learning (GBL) obtains huge response and appreciation nowadays, the GBL plays a vital role in learning physics through these games. At every level of this game, to kill the pigs (target), some birds are used to hit the target. These actions can be used to understand the concepts of physics. Nowadays, kids are frequently playing angry bird game and spending several hours a day to complete various levels of game. We have attempted to modify the interface of this game to make it useful for students and teachers. Moreover, kids during game play can also learn basic concepts also. From the experiment conducted in two groups, i.e., using GBT with lectures and without GBT, the study attained the results shown in Figure 7. It is shown that when the GBT used in class as a supplementary tool for lectures, 30% of the class obtained 80% of scores while 25% of the students obtained 80% of the scores in the class where the lectures conducted without GBT. Figure 7 is used to show the results of experiment conducted.
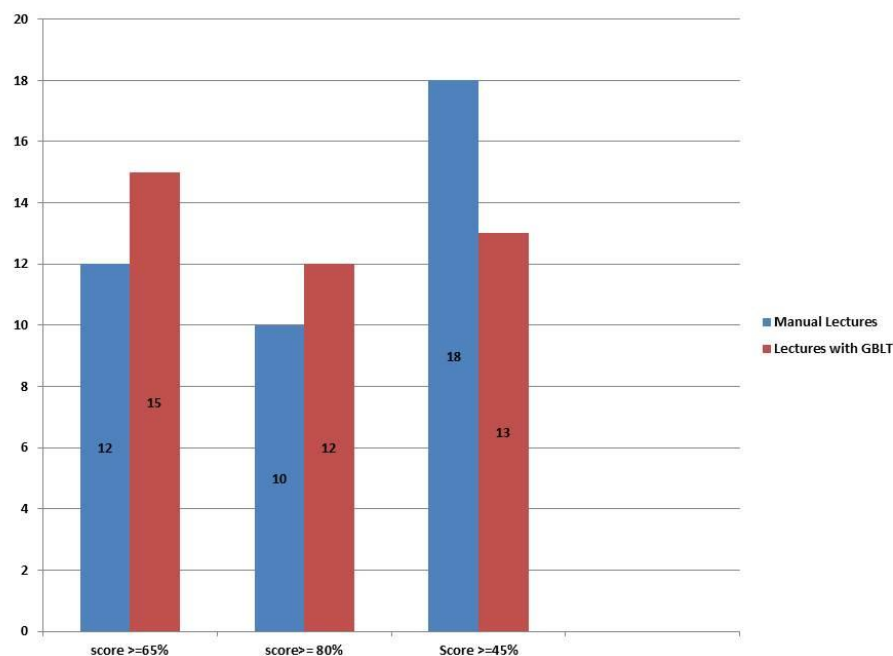
Fig 7. Results acquired from the two groups of students

In the future, the extended version of this tool may be developed because this tool was developed only to teach the basic physics principles. This tool may be extended to teach the advanced concepts of physics by not only including the learning material into interface but also the game's interface may be extended by enhancing its targets.

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